

DWR  
AGRICULTURAL DRAINAGE PROGRAM

MONITORING AND EVALUATION

REDUCTION AND REUSE

TREATMENT

EVAPORATION PONDS

OTHER:

AGROFORESTRY

SALT UTILIZATION

FLOW THROUGH WETLANDS

*Cat III proposal submitted as DWR*

## TREATMENT ACTIVITIES

### SELENIUM REMOVAL

ADAMS AVENUE TRIALS

PANOCHE PROPOSAL

FLOW THROUGH WETLANDS

### REVERSE OSMOSIS

UCLA STUDIES

PROPOSED PILOT UNIT

### SOLAR POND PROPOSAL

### SALT UTILIZATION

### AGROFORESTRY

## ADAMS AVENUE TRIALS

TRIALS RUN BETWEEN SEPTEMBER 1992 AND NOVEMBER 1995

TDS 8,500 ppm

SELENIUM 525 ppb

UPFLOW ANAEROBIC SLUDGE BLANKET REACTOR

FLUIDIZED BED REACTOR

PACKED BED REACTORS

SLOW SAND FILTERS

### RESULTS

NEED TO REMOVE NITRATES BEFORE SELENIUM IS REDUCED

MAXIMUM REMOVAL RATE EXCEEDED 90%

PROCESS WAS ERRATIC AVERAGE REMOVAL RATES LESS THAN 60%

EFFLUENT WOULD NOT MEET DISCHARGE STANDARDS

PROCESS WAS COSTLY (\$167 to \$333 per AF for methanol)

### POTENTIAL PROCESS REFINEMENTS

REACTOR DESIGN

SELENIUM SPECIFIC BACTERIA

LESS EXPENSIVE FEED STOCK

PROGNOSIS - NO MANDATE TO CONTINUE

## PANOCHÉ PROPOSAL

MOST OF SELENIUM LOCATED IN A FEW CONCENTRATED AREAS

TDS 3,000 ppm

SELENIUM 900 ppb

- REGULATED BY MASS LOADINGS NOT CONCENTRATIONS

PROCESS ECONOMICS BASED ON AVOIDANCE OF PENALTIES

FOCUS ON NITRATE REMOVAL

USE DEVELOPED TECHNOLOGY

STEP BY STEP REFINEMENT OF PROCESS

FLOW THROUGH WETLANDS

TLDD/UC SALINITY DRAINAGE PROGRAM

TLDD TRIALS

TDS 6,000 ppm      SELENIUM 95 ppb (avg) max 2200 ppb

SELENIUM CONCENTRATIONS IN PONDS DECREASE

VEGETATION UPTAKE

VOLATILISATION

TISSUE STORAGE

SEDIMENTS

IDENTIFY & MANAGE EFFECTIVE REMOVAL ELEMENTS

WETLAND ABOUT 10% OF TOTAL POND AREA

PRESENT EVAPORATION PONDS BECOME WILDLIFE SAFE

DWR PARTICIPATION

UC DRAINAGE SALINITY CONTRACT

DIRECT PARTICIPATION

FLOW THROUGH WETLANDS  
PROPOSED STUDIES

LOST HILLS WATER DISTRICT STUDY

TDS 21,000 ppm                      SELENIUM 300 pp**b**

FRESH WATER (FRESHER WATER) PULSES

ALGAE BLOOM AND PERISH

SELENIUM REMOVAL RATES GO UP

CONFIRMED BY UC LAB STUDIES

STUDY STATUS

RAINBOW RANCH STUDY

TDS 78,000 ppm                      SELENIUM 350 ppb

LOW SELENIUM LEVELS IN EMBRYOS

SELENIUM IN WATER EMBRYO SELENIUM PREDICATIONS

STUDY MOVEMENT OF SELENIUM FROM WATER TO BIRDS

PONDS OPERATED TO ACHIEVE UNIFORM TDS LEVELS IN ALL CELLS

THERMAL LAYERING OBSERVED

WHAT IS HAPPENING?

PHYSICALLY & CHEMICALLY

BIOLOGICALLY

CAN WE CONTROL AND REPEAT THE PROCESS?

## REVERSE OSMOSIS

### OBSTACLES - REMEDIES

#### POWER COSTS

#### LOW PRESSURE MEMBRANE DEVELOPMENT

#### MEMBRANE FOULING

#### UCLA MEMBRANE CHARACTERISTICS AND FOULING STUDIES (Slide)

#### DISPOSAL OF BRINES

#### SOLAR POND STORAGE (Slide)

#### CRYSTALLIZATION

#### EVAPORATORS

#### PORTABLE PILOT PLANT PROPOSAL (Slide)

## UCLA STUDIES

### MEMBRANE PROPERTIES

HYDROPHILIC AND HYDROPHOBIC CONDITIONS

ZETA POTENTIAL - ELECTRICAL SHEAR PLAN POTENTIAL

### FOULING STUDIES

COLLOIDAL FOULING

NATURAL ORGANIC MATTER

INORGANIC MATTER

CALCIUM SCALING

BIOLOGICAL GROWTH

### COLLOIDAL FOULING CONTROL

PH

SURFACTANT TO CONTROL:

CATION CONCENTRATIONS

ANION CONCENTRATIONS

### CALCIUM SCALING CONTROL

ANTISCALANT COMPOUNDS

REPLACES ION EXCHANGE TECHNOLOGY

### LABORATORY SCALE:

SYNTHETIC DRAINAGE WATER

POSTAGE STAMP MEMBRANES



RO PILOT PLANT  
PROPOSAL

TEST ANTIFOULING TECHNOLOGY

VARIOUS REAL WORLD CONDITIONS

PORTABLE PILOT TESTING UNIT

COMMERCIALY AVAILABLE MEMBRANES

TWO STAGE TESTING CAPABILITIES

EXPANDABLE DESIGN

EPA OR CALFED FUNDING

WIDE SUPPORT BASE AND INVOLVEMENT

DESK STUDY FOR SPECIFICATIONS AND COSTS

WORKSHOP IN NEAR FUTURE

SOLAR POND  
INITIAL PROPOSAL

CHARACTERISTICS

THREE LAYERS ABOUT 12 FEET DEEP

INSULATING SURFACE LAYER OF COOLER FRESHER WATER

TRANSITION THERMAL GRADIENT LAYER

HOT BRINE LAYER

BENEFITS

WILDLIFE SAFE STORAGE OF SALTS AND SELENIUM

SOURCE OF ENERGY

LOS BANOS FINDINGS

COMPLEX AND DIFFICULT TO OPERATE

BOUNDARY EFFECTS ON ½ ACRE PONDS WERE SIGNIFICANT

INITIAL DEMONSTRATION PROPOSAL

THREE ACRE SOLAR POND TO REDUCE BOUNDARY EFFECTS

DETERMINE PRACTICAL OPERATING PARAMETERS

DEVELOP OPERATOR EXPERIENCE

MEASURE THERMAL OUTPUT POTENTIAL

DETERMINE QUANTITY AND QUALITY OF OUTFLOW

DEVELOP ESTIMATES FOR BASIC POND CONSTRUCTION AND OPERATING COSTS

SOLAR PONDS  
FOLLOW UP DEMONSTRATIONS

MANAGEMENT OF EFFLUENT

USE OF THERMAL ENERGY

CONVERSION TO ELECTRICAL ENERGY

HEAT FOR COOL SEASON AQUACULTURE

POWER FOR EVAPORATION OF EFFLUENT AND SALT RECOVERY

LOW PRESSURE EVAPORATOR

POWER FOR CRYSTALLIZER

HEAT SUPPLEMENT FOR SOLAR EVAPORATOR

HEAT STORAGE

## SALT UTILIZATION

CHANGE DRAINAGE SALT FROM A WASTE TO A COMMODITY

SJV SALT ACCUMULATION IS 2,450,000 TONS PER YEAR

EXPAND EXISTING MARKETS (425,000 TONS PER YEAR)

DETERGENT FILLER

FABRIC DYES

GLASS PRODUCTS

PAPER PRODUCTS

### NEW MARKETS

EXPANSION OF USAGE IN GLASS PRODUCTS - UC DAVIS

EXPANSION OF USE IN FABRIC DYES - PROPOSED UC DAVIS

SULFUR CONCRETE

ECOBLOCKS

## AGROFORESTRY

A SYSTEM OF SALT REDUCTION AND REMOVAL SUITED TO INDIVIDUAL FARMS

SEQUENTIAL REUSE OF DRAINAGE WATER BY CROPS WITH INCREASING SALT TOLERANCE

SALTS REMOVED IN A LINED SOLAR EVAPORATOR

DEMONSTRATIONS

TLDD - NO SOLAR EVAPORATOR

MENDOTA

RED ROCK RANCH - RECLAMATION OF 640 ACRE PARCEL

WORKS FOR THE INTERMEDIATE TERM

SUCCESSFULLY ESTABLISHED SALT TOLERANT CROPS

PROBLEM AREAS:

SUSTAINABILITY OF SOILS IRRIGATED WITH SALINE WATER

TREE LOSSES

LONG TERM MANAGEMENT OF SALT TOLERANT CROPS

IMPACTS ON WILDLIFE

ECONOMICS

TOXIC PIT ACT DEFINITIONS/ STANDARDS